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Proceedings of the Regional Science Advisory Process on the Assessment of Methods for the Identification of Critical Habitat for Freshwater Mussels

Compte rendu du processus d'avis scientifique régional sur l'évaluation des méthodes d'identification de l'habitat essentiel des moules d'eau douce

28 April 2011

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Burlington, ON

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Le 28 avril 2011

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Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. Le compte rendu peut aussi faire l'état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

A regional science peer-review meeting was held on 28 April 2011 in Burlington, Ontario. The purpose of the meeting was to peer review approaches, and the information required, for the identification of critical habitat for freshwater mussels. This review included the assessment of methods that may be used to identify critical habitat for freshwater mussels and the review of the conceptual framework for identifying critical habitat for freshwater mussel species at risk throughout their range that be may adapted for broader usage. The resulting Science Advisory Report includes recommendations and guidance on techniques to be used in the delineation of critical habitat. Meeting participants included experts from Fisheries and Oceans Canada (DFO), Ontario Ministry of Natural Resources, Portt and Associates, and Central Michigan University.

This Proceedings report summarizes the relevant discussions of the science advisory meeting. The Proceedings and the Science Advisory Report, resulting from this advisory meeting, are published on the DFO Canadian Science Advisory Secretariat Website at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

SOMMAIRE

Une réunion régionale d'examen scientifique par des pairs a eu lieu le 28 avril 2011 à Burlington, en Ontario. La réunion avait pour but d'évaluer par les pairs des méthodes, ainsi que des données requises, d'identification de l'habitat essentiel des moules d'eau douce. Cet examen comportait l'évaluation des méthodes pouvant servir à déterminer l'habitat essentiel des moules d'eau douce et l'examen du cadre conceptuel permettant d'identifier, dans toute leur aire de répartition, l'habitat essentiel des espèces de moules d'eau douce en péril susceptible de convenir à une utilisation plus vaste. Dans l'avis scientifique rédigé à la suite de cette réunion figurent des recommandations et des conseils sur les techniques à utiliser pour délimiter l'habitat essentiel. Les participants à la réunion étaient des experts de Pêches et Océans Canada (MPO), du ministère des Richesses naturelles de l'Ontario, de Portt and Associates et de la Central Michigan University.

Le présent compte rendu résume les discussions pertinentes de la réunion de consultation scientifique. Le compte rendu et l'avis scientifique qui ont été rédigés à la suite de cette réunion de consultation sont publiés sur le site Web du Secrétariat canadien de consultation scientifique du MPO à l'adresse suivante : http://www.dfo-mpo.gc.ca/csas-sccs/index-fra.htm.

INTRODUCTION

The co-chair welcomed participants and asked the participants to introduce themselves and give a brief description of their background. The co-chair described the purpose of the meeting and explained that we would be presenting different scenarios as case studies to be considered when describing mussel critical habitat. The co-chair also briefly reviewed the Agenda and the Terms of Reference, indicating that we were in attendance at a formal peer-review meeting. The co-chair described the objective of the meeting, in that the meeting was being held to assess the methods that may be used to identify critical habitat for freshwater mussels. He also explained that the advice developed at the meeting would be used to inform decisions regarding the identification of critical habitat for species at risk mussels throughout their range. He also explained what deliverables would be produced as a result of the meeting and where these documents could be found.

DETAILED DISCUSSION

ASSESSMENT OF METHODS FOR THE IDENTIFICATION OF CRITICAL HABITAT FOR FRESHWATER MUSSELS

Presenter: Todd Morris

Background

The co-chair began his presentation by introducing the background to the identification of critical habitat, which included the *Species at Risk Act* definition of critical habitat, and where the identification of critical habitat is found in the species at risk listing process. He continued by introducing the participants to the chronology of how the identification of critical habitat has evolved over time, highlighting key documents that have been developed and vital meetings that have occurred. A participant explained that any freshwater mussel recovery strategies that have been posted that are lacking the identification of critical habitat will be re-opened and revised to include critical habitat.

Approach

Once the background information was provided, the co-chair continued to present the suggested approach to be used in the delineation of critical habitat. He introduced the two major components generally used in the identification of critical habitat: the geospatial component and the function description. In first discussing the geospatial component the co-chair presented both recovery target dependent and recovery target independent methods. While presenting the recovery target dependent methods, the presenter introduced the concept of minimum viable population (MVP) and the use of density estimates to approximate the area of habitat required to support the MVP. He indicated that although the MVP approach was used in the Wavy-rayed Lampmussel (WRLM) Recovery Potential Assessment (RPA) the level of information required to apply this type of approach to any other mussel species in Ontario is simply not available.

During the presentation of the MVP results, a participant asked whether or not the values provided represented the number of live adults. The presenter clarified that the numbers represented the number of live adult females.

One of the challenges identified in utilizing the WRLM MVP values was to extrapolate this information to quantify the amount of area required to support the population size identified. For fish, an area per individual (API) approach is utilized to aid in this extrapolation, but unfortunately, this type of approach is not presently available for mussels. An alternate

approach discussed was to simply utilize known densities of a species in a particular system and apply the MVP to determine the area of habitat that could support the MVP.

Another challenge was discussed in how to quantify the proportion of the habitat that may be suitable for the species, as it is likely that not all the habitats present in a system may be suitable. No solutions were provided.

A participant indicated that the same problem does exist for fishes in that it is unknown what proportion of the habitat may be suitable for the species. The participant indicated that one should not only consider whether or not the habitat was suitable, but also the level of habitat quality should be considered. Another participant indicated that another difficulty is that although habitat information does exist from the quadrat studies that have been completed on many rivers inhabited by freshwater mussels, the habitat sampling was not completed through randomized sampling approach, rather, habitat information is only available for areas where mussels are known to exist in high abundance. Participants agreed that applying a randomized sampling design would help resolve questions surrounding the proportion of suitable habitat, and habitat of high quality, but unfortunately this type of data does not exist at this time.

A participant asked whether or not density estimates currently exist for all species for all rivers. The presenter responded that density estimates are available for most mussel species at risk but the information is quite sparse for rare species. The presenter reminded participants that MVP is not currently available for any species other than WRLM.

As an aside a participant cautioned that MVP should not be applied blindly without some knowledge of the population. For example, it should be known whether different age classes are present in the population as well.

A participant mentioned that since the information is not currently available to apply the MVP approach to any other species, other than WRLM, then the field work necessary to obtain the needed estimates should be included in the schedule of studies for all other species.

The presenter inquired if any participant had another approach they wanted to bring forward to be discussed by the group. The participants did not know of a better recovery target dependent approach.

The presenter then moved on to possible recovery target independent approaches that may be more applicable to freshwater mussels than the recovery target dependent approaches that require information not presently available. After presenting the various Area of Occupancy (AO) approaches the presenter opened the floor to discussion. A participant requested clarification on what type of data is used when applying the AO approach. The presenter responded that for presentation purposes all data points related to the known distribution for a species was used, but this does not necessarily have to be the case. Data quality issues should also be discussed before applying an AO approach. The presenter informed participants that data quality issues will be discussed at a later point in the day. A participant also inquired as to whether or not separate populations of the same species would be assigned a separate AO or would be combined to form one large AO. The presenter responded that if there was genetic evidence of multiple populations then a separate AO could be assigned, but in most cases all data points would be combined into one large AO.

Participants noted that they did not particularly like the feature envelope approach as the boundaries are not ecologically meaningful. While this is true, it is noted that the rigid lines of the feature envelope approach do create an easily distinguishable boundary since they follow the lats and longs of the points of occurrence.

Data Quality

One of the largest obstacles faced when utilizing freshwater mussel data is determining the quality of the data available. The participants discussed when a record should be considered historic and when a record should be considered current. The presenter explained that one of the cut off points that has been applied in the recovery strategies, in terms of the year the record was collected, is based on sampling effort. Generally it is agreed upon that the mid- to late-90s represented the time were a concerted effort to collect freshwater mussel data began. Most records prior to this time period are not complete, in that they may be missing information on abundance, the state of the individual recorded (live or shell), or sampling effort in locations where the species was not detected.

A participant suggested that perhaps the methodology that has been applied to determining fish data quality should be applied for freshwater mussels. This included following a general rule that if a historic record falls within the current known area of occupancy then it should be included. In response to this, another participant raised concern related to the historic presence of freshwater mussels throughout the Great Lakes, and whether applying this method would result in delineating all the Great Lakes as critical habitat. It was clarified that if there is more current information indicating that a species is no longer present in an area then the historic records would no longer be used in the delineation of critical habitat. Another participant cautioned that this raises two concerns. The first concern being whether or not the habitat still has the potential to be used as recovery habitat; and the second being whether the area has been recently sampled using appropriate techniques and effort and has failed to detect the species. Again, borrowing from the guidelines used for delineation of fish critical habitat, one participant suggested that critical habitat should be limited to areas where extant populations are known to exist. It was decided that information related to whether a population was extant should come directly from the RPA process. If this information is not available from the RPA process, the decision on whether a population is extant should be left at the recovery team's discretion.

Buffers

The presenter subsequently presented information on buffering techniques and a discussion was had related to whether a buffer should be applied to an AO, and if so, what type of buffer should be used and how should it be defined. The presenter provided two reasons why buffering the AO may be appropriate. Firstly, buffering may take into account uncertainty related to the spatial and temporal issues surrounding sampling. Secondly, buffering may take into account the biological consideration that these animals, and their hosts, are capable of moving in their environment. Three buffering techniques were presented to the group: 1–a fixed-distance buffer; 2–a buffer based on an ecological classification system; and, 3–a buffer that is based on the host fish (i.e., home range).

During the fixed distance buffer presentation a participant asked when there is overlap in the buffer from two points what happens to the overlap area. The presenter responded that it is added on to the buffer extending the buffer further outward until the pre-determined area size is reached.

Participants inquired as to why a 500 m buffer area was selected. It was explained that the 500 m value is related to the standard COSEWIC applies when determining AO. Participants felt as though this value had no biological basis.

One participant asked how other habitat features, such as depth, would play a role in the delineation of the buffer surrounding the point. The presenter replied that other habitat features

could be used as a functional attribute of the species to further refine or re-shape the buffer. For example, if a species was known to have a depth preference the buffer could follow the appropriate depth contour until the fixed area is reached.

One of the participants suggested that a cost buffering could occur with other habitat characteristics such as sediment or depth during the geospatial delineation portion of the process rather than applying a restriction as a functional attribute. It was agreed that the buffer could be bound by any habitat feature that we had enough information to use. Habitat characteristics suggested by participants that could be used in this matter included depth, macrophyte density, and sediment type.

A participant inquired whether we could use the distance a mussel travels to buffer the points of occurrence, and if this information was available for most species. The presenter responded that this information is available, although it may be more appropriate to buffer the distance travelled by the host since the distance travelled by a mussel is quite small.

The second buffering approach presented was the application of a buffer related to an ecological classification system. The presenter described the ALIS (Aquatic Landscape Inventory System) that has been typically applied to riverine fish species. In brief, ALIS delineates stretches of rivers based on landscape variables. Ideally, habitats found within one ALIS segment are grouped based on their similarities and therefore if a species is found in one part of the ALIS segment it can be expected to be found in other areas of the same segment.

One participant asked whether ALIS is only available for rivers. The presenter responded that yes, this system is only available for rivers.

A discussion was had on Aquatic Resources Areas (ARAs) and whether ARAs were similar to ALIS segments. A participant noted that ARAs might be a more refined method to classify rivers as it is based on both biological and habitat characteristics. Another participant indicated that they were intrigued by the ARA approach but one downfall is that ARAs are not currently available for the majority of the watersheds in Ontario.

The presenter reminded participants that the discussion should not be related to which ecological classification should be used, but rather, should be related to the general approach of using an ecological classification system. It was agreed by participants that an ecological classification system should be applied. It was also agreed that specific information on how the breaks are created in the ecological classification system should be known to better make a judgment on how it should be applied.

One participant asked whether or not we should include habitats where the juvenile mussel is shed by the host fish even though it does not survive in those areas. The presenter clarified that there is a protection required for the glochidia while it is encysted on the host fish, and also a protection required for the juvenile mussel once it has been dropped off.

The presenter reiterated that there was a general consensus that we like the idea of an ecological classification system, if it is available. Although, depending on the information used to create the ecological classification system, it may be more appropriate and defensible to be applied as a buffer.

One participant noted that all of the ecological classification systems discussed only incorporated river systems, and thinks that something can be done at a lake level to determine different types of habitat across a lake. Another participant indicated that this type of information

would be very helpful but currently does not exist.

The last type of buffer introduced by the presenter incorporated the use of a fish host buffer. One participant noted that if a buffer was used it would depend on water body size, and the application of a linear home range versus an area home range will drastically alter the results. A participant noted a difficulty in using one common home range approach is that when applying the approach to a small species that is present in a very large system the home range became very large and seemed unrealistically large. Another participant indicated that it is very difficult to apply fish home range limits as a buffer without having associated telemetry data to support the home range limits.

The presenter reminded participants that we should be discussing the concept of applying a home range buffer rather than discussing the specifics of how the home range buffer would be calculated. It was agreed that the concept of buffering by a biological component of the host should be considered. Participants agreed that conceptually applying a home range buffer is something participants could agree with, although logistically it was unsure how it could be applied.

A participant inquired whether critical habitat currently includes unoccupied recovery habitat. Another participant responded that to date critical habitat has not included recovery habitat, but this is a discussion that should be left with the recovery team.

Case Studies

A1 – Single record – Inland lake system

The first case study discussed was that of a closed inland lake system in which a single individual has been recorded. It was decided that before a method is discussed it should be determined whether or not the single record represents a population. It was clarified that the determination of populations should be completed through the RPA process. The RPA process will determine whether or not a location/data point should be considered a population.

It was recommend that if the RPA concluded that it was unknown as to whether or not the single record represents a population, critical habitat can not be determined until additional research has been completed. If the RPA concluded that a population does exist, the whole lake approach should be implemented.

The participant discussed the buffering method once again. The participants did not like the visual representation resulting from the cost-distance analysis. It was decided that a radius should be used instead because it would soften the edges and look more like a circle radiating from the record. The reason provided for using the cost-distance approach was explained to simply be one of processing time. Creating the smooth edge to the critical habitat area would be very time-consuming. The participants subsequently had a discussion on whether it would be a possibility to automate the process. Participants were unsure if this is a possibly considering the uniqueness of each location/species distribution.

A2 – Multiple records (only presence records available) – Inland lake system

The discussions of scenario A1 were expanded in scenario A2 where multiple positive records were available in a closed inland lake system. The participants mentioned that incorporating habitat type in the geospatial delineation was important. The co-chair clarified that incorporating habitat type/preferences would occur when discussing functional habitat and the first step is to determine the geospatial boundaries, which should not be related to key habitat characteristics.

It was recommended that if multiple records occur throughout an inland lake, the whole lake approach should be used when delineating the geospatial boundaries.

A3 – Multiple records (presence/absence data available) – Inland lake system
The final inland lake scenario was presented, in which both presence and absence data was available. It was suggested that when you have limited information you should apply the precautionary approach until additional information is available. With the additional information (e.g., habitat preferences) you can begin to exclude areas based on this information. Again, it was reiterated that the habitat characteristics should be included in the functional attributes of the species.

It was recommended that when both presence and absence data is available at various locations throughout a closed inland lake system and no additional habitat information is available (to exclude areas), the whole lake approach should be applied. However, when both presence and absence data is available at various locations throughout a closed inland lake and additional habitat information is available related to these records, the available habitat information should be used to correlate the presence/absence data with habitat. This would allow you to buffer by habitat, which is ideal. If it is possible to refine the various habitat types in the system then buffering by habitat type should be applied. The information available for a species and its habitat preferences can be used to refine the functional description.

B – Coastal areas
St. Clair delta – The group had an in-depth discussion surrounding the 1-m contour line buffer that was applied as one of the examples. The group felt as though this may be arbitrary if the species is known to exist at deeper depths. The co-chair clarified that it may be applicable in the Lake St. Clair system as it is known that certain species do not occupy waters at deeper depths due to competition with zebra mussels. It was decided that as long as there is a rationale for applying the contour and it can be justified, then it should be used.

The group discussed the incorporation of the impacts of zebra mussels and their affect on native mussel populations. It was decided that if there are known affects from a threat (i.e., zebra mussels) then it could be incorporated in the functional description. The 1-m depth contour may make sense for Lake St. Clair because at this depth zebra mussels restrict the presence of native mussels, but the 1-m depth contour may not make sense to apply to other systems where zebra mussels are not present.

There was some discussion on how to apply a breakpoint. It was decided that the breakpoint should be bound by a biologically meaningful parameter. Potential parameters discussed included the presence of zebra mussels or depth.

The group recommended that when delineating the geospatial boundary in a coastal area that a holistic approach is favored, as opposed to a patchy approach. They also recommended that the boundaries should be bound by some ecologically significant parameter and should be biologically defensible. The group also agreed that the breakpoint should be ecologically significant, or based on the results from field sampling. For example, the group would be comfortable cutting the critical habitat at the mouth of rivers because this would delineate the boundary between lacustrine and riverine habitats.

The participants discussed the relevance and feasibility of delineating critical habitat based on multiple species at risk occurring in one area. The question was raised whether it would be appropriate to simply overlay the distribution of all species at risk in an area and delineate critical habitat accordingly. It was clarified that this approach would not be appropriate. This

approach would create difficulties if any of the species were down-listed in the future. Also, it would not be defensible when we are discussing the critical habitat for a single species. It was agreed that critical habitat should be assigned on a species-by-species basis, and a multi-species approach is not appropriate.

The participants discussed the difference and similarities of delineating critical habitat at the federal and provincial levels. There may be a difference in the interpretation of critical habitat at these two levels of government. The participants have highlighted this concern.

The Long Point and Turkey Point examples were also presented to the group. The group agreed that the above recommendations could be applied to any coastal area. It was agreed that one should attempt to find ecologically significant breakpoints. In the absence of an ecologically significant break, any areas with similar habitat characteristics should be included in the geospatial boundary.

The group returned to the cost distance analysis and came to the same conclusions as the previous discussions. The group did not like arbitrarily choosing a 500-m buffer. The buffer should be ecologically based and not arbitrarily selected. The group agreed that the buffer should be scientifically sound and will differ across species as our knowledge base varies by species.

C – Open lake

It was decided by the group that there was no need to discuss the open water scenario. It was decided that it was too hypothetical to discuss as most open water systems are now affected by zebra mussels and are no longer being used by freshwater mussels.

D1 – Upper tributaries

The co-chair presented the first of two riverine scenarios, the upper tributaries. The group discussed mapping based on buffering the extents of the distribution, buffering the extents by 500 m, and mapping the distribution based on the ALIS segments. One of the difficulties in using the ALIS segments is that in some areas it can create very fragmented coverage, while in others a system can be one large ALIS segment (ex. Sydenham River).

One of the participants described the variables used to create the ALIS segments to give the participants a better understanding of the data being incorporated into the predictive model to create the segments.

Participants discussed highlighting the ALIS segment between two highlighted ALIS segments if the area had not been sampled, and excluding areas where sampling had occurred but had failed to detect the species. Participants discussed if this type of decision making process can be automated. One participant noted that this approach would be consistent with both the open lake approach and the approach that is currently used for fish critical habitat delineation.

The group recommended the use of ALIS segments (or another ecological classification system) to delineate critical habitat in upper tributaries. It was also recommended that if a segment has not been sampled between two positive ALIS segments then the segment should be included. Additionally, if a segment between two highlighted ALIS segments has been sampled but the sampling efforts have failed to detect the species, or if there is additional habitat information available for the segment that does not align with the known preferred habitat of the species, the segment could be excluded.

One participant asked what you would do if you had a single line river that flowed into a lake. They questioned if the whole lake should be highlighted as well because the lake is not a part of

the ALIS segment layer. The group agreed that the decision would be left with the recovery team because it would depend on the species and whether or not it was known to prefer the type of habitat in the lake. The group suggested that the lake should be included but then may be excluded once the functional attributes of the species are applied.

A participant questioned what would be done if the sampling point is found at the very end of an ALIS segment. It was decided that in this scenario the segment should be buffered by the fish' home range, or some other biological buffer, and not automatically included or excluded.

D2 – Lower river

An example of a lower river system was presented to the group. The group discussed mapping based on buffering the extents of the distribution, buffering the extents by 500 m, and how we should handle the lake/river interface.

The group agreed that the same approach would be used in the lower river as was discussed previously for the upper tributary scenario (i.e., use of ALIS segments, or other ecologically significant characteristics to delineate geospatial boundaries). The group subsequently discussed how the river mouth would be handled.

A participant noted that this scenario is similar to the one previously presented of the St. Clair delta. Another participant observed that there is one key difference between the two scenarios. In the St. Clair delta scenario the species would be moving from open water into the rivers (against water flow), while in the lower river scenario, the species would be moving from the river into the lake (with water flow). Another participant also noted that this scenario is slightly different because we can have river-type conditions in the lake.

The group agreed that the river mouth should be buffered using ecologically significant characteristics. An example that was discussed was buffering by fish host home range. The group would like to see the application of a biologically/ecologically sound parameter for buffering and not an arbitrarily chosen value (i.e., 500 m).

E – Connecting channels

It was determined that the method used to define critical habitat in a connecting channel would be very similar to the method described above for coastal areas. However, the group did highlight the need to consider the border when delineating critical habitat. It was decided that the geospatial boundary would be simply clipped at the border; you would not re-allocate the area clipped in Canadian waters.

The group recommended that connecting channels should be treated in the same way as coastal areas. Breakpoints should be based on locations where sampling has occurred but has failed to detect the species. If there is no additional sampling efforts near the location where the species was detected one should follow the same rational as was discussed for the coastal areas scenarios to delineate the boundary.

Aside

The cost distance analysis was revisited. The example presented was to use a cost distance analysis to buffer a point by the home range size (of either a mussel or its host). Instead of including an area around the point that is equivalent to the home range, you would simply apply a radius from the point (Euclidean distance) equivalent to the home range. A linear home range distance would be applied and this home range distance would be centered on the point of detection. The participants agreed that this method is more appropriate than maintaining a pre-determined area.

Functional Description

The last topic to discuss was the functional descriptions. It was requested by one of the participants that a list of generic functions, features and attributes be generated by the group. One of the participants gave an example of functions, features and attributes that were recently used for a fish species. The following list of generic features and attributes were generated for the adult/juvenile and glochidial life stages.

Attributes associated with the adult/juvenile life stage

- Substrate
    - Composition (particle size)
    - Compactness
    - Stability
- Fluvial geomorphology (rivers)/coastal processes and sediment transport (lentic)
    - Riffle, run, pool
- Water quality
    - Turbidity and suspended solids
    - Dissolved oxygen
    - Pollutants
    - Metals
- Flow rate
    - Maximum flow rate, minimum flow rate, optimal or preferred flow rate
    - Current velocity
- Preferred water depth
- Food source
- Biological pressure — Negative influence from aquatic invasive species (i.e., Zebra Mussel, Round Goby)

Attributes associated with the glochidial life stage

- Host species
- Timing of fertilization
- Timing of glochidial release
- Host density and community composition, if more than one host fish is used
- Size/age of host fish
- Size/age of mussel
- Level of immunity of host fish

A participant raised the concern that by creating this type of list that the relationship to the host fish may be lost. The co-chair explained that the importance of that relationship would not be lost since it is captured in the attributes associated with the glochidial life stage.

CONCLUSIONS

The co-chair concluded by summarizing the discussions of the day. The attributes list was reviewed by participants to ensure all characteristics were captured in sufficient detail. The co-chair re-iterated when the products of the meeting would be completed, and that we would be seeking the participants input when reviewing both the proceedings and the science advisory report.

Appendix 1. Terms of Reference

Assessment of Methods for the Identification of Critical Habitat for Freshwater Mussels

Regional Advisory Meeting

28 April 2011
Burlington, ON

Co-chairpersons: Lynn Bouvier and Todd Morris

Context
Fisheries and Oceans Canada (DFO) Science has been asked to provide peer reviewed approaches, and the information required, for the identification of critical habitat for freshwater mussels. Possible approaches to define critical habitat are required for mussels in riverine and lacustrine habitats. Although some approaches to the identification of critical habitat have been explored using known habitat preferences combined with existing habitat data in a single watershed, such methods are not adaptable to the full range of habitat conditions where Species at Risk (SAR) mussels occur in southwestern Ontario.

Current SAR policies recommend that science information to support the identification of critical habitat in Recovery Strategies and Actions Plans be peer reviewed. A peer review of the conceptual approaches to identifying critical habitat for four Ontario fishes was conducted in May 2008 and these approaches will be considered when developing methods specific to freshwater mussels. However, there has been no peer review related to possible methods for the identification of critical habitat for mussels. Approaches to define the spatial availability and/or suite of habitat features that may be required in the identification of critical habitat will be presented and discussed. In addition, basic functional differences between benthic, sedentary mussels and active fishes will be discussed, as well as the implications that these differences may have on the identification of critical habitat. Another unique mussel life cycle characteristic to be considered is the utilization of fish hosts and the implications that this may have on critical habitat identification.

Objectives
This advisory meeting is being held to assess the methods that may be used to identify critical habitat for freshwater mussels. Advice developed at the meeting will be used to inform decisions regarding the identification of critical habitat for SAR mussels throughout their range.

Expected publications
The meeting will generate a proceedings report summarizing the deliberations of the participants. This will be published in the Canadian Science Advisory Secretariat (CSAS) Proceedings Series. Advice from the meeting will be published in the form of a Science Advisory Report. This report will be published in the CSAS Science Advisory Reports Series.

Participation

Experts from DFO, Ontario Ministry of Natural Resources, Central Michigan University, and Portt and Associates have been invited to this meeting. Participants will not exceed a maximum of 10 people.

Appendix 2. Meeting Participants

Assessment of Methods for the Identification of Critical Habitat for Freshwater Mussels

Regional Advisory Meeting

28 April 2011

Burlington, ON

LIST OF PARTICIPANTS

Last Name	First Name	Affiliation
Bouvier	Lynn	Fisheries and Oceans Canada
Coker	George	Portt and Associates
Doolittle	Andrew	Fisheries and Oceans Canada
Gibson	Scott	Ontario Ministry of Natural Resources
Ming	Debbie	Fisheries and Oceans Canada
Morris	Todd	Fisheries and Oceans Canada
Randall	Bob	Fisheries and Oceans Canada
Staton	Shawn	Fisheries and Oceans Canada
Woolnough	Daelyn	Central Michigan University

Appendix 3. Agenda

Assessment of Methods for the Identification of Critical Habitat for Freshwater Mussels

Regional Advisory Meeting

Burlington, ON

Co-Chairpersons: Lynn Bouvier and Todd Morris

Thursday, 28 April 2011	
9:00 am	Introductions and Terms of Reference
9:30	Background
10:30	Break
10:45	Approach
12:00	Lunch (not provided)
1:00	Case studies
3:00	Break
3:15	Case studies (continued)
4:00	Functional description
4:30 pm	Wrap-up